DOCUMENT RESUME

ED 437 280 SE 063 055

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TITLE An Introduction to Adults Count Too.
PUB DATE 1998-00-00
NOTE 9p.; Paper presented at the Adults Learning Mathematics Conference (4th, Limerick, Ireland, July 4-6, 1997).
PUB TYPE Opinion Papers (120)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Adult Education; Foreign Countries; *Learning Strategies; *Mathematics Education; Number Concepts; *Numeracy

ABSTRACT

This paper provides an overview of a book entitled "Adults Count Too: Mathematics for Empowerment". The introduction to the book details why the author spent three years writing about adults learning mathematics, and outlines the shape and structure of the book. A chapter from the book, entitled "A Matrix of Factors," is presented as an example of the book's style and to offer a peek at understanding the needs of adults learning mathematics and strategies for teaching them. (ASK)

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An Introduction to Adults Count Too

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The Adults Learning Mathematics Research Forum has been an important part of my professional life since its inception four/five years ago. I have attended every Conference and found it an excellent opportunity to try out my ideas on a group of colleagues with similar interests to my own. Hence this year I felt no (or little) qualms in using my session to give participants an overview of my book *Adult Count Too: Mathematics for Empowerment* which was published in June this year by NIACE. This paper will do the same. First, the introduction to the book details why I spent three years writing about adults learning mathematics and outlines the shape and structure of the book. The one chapter *A matrix of factors* will be given for a flavour of the book.

As a schoolgirl, I fell in love with mathematics. I thought it was a wonderful subject - to me, it epitomised elegance, beauty and simplicity. (It had the added advantage that there was minimal use of English and I was an abominable speller...)

My subsequent educational pathway was, as is the case for many of our adult students, very chequered. One small baby later, I embarked as a mature student on my mathematics degree. Like most adult learners, I was committed and highly motivated. After gaining my degree, I taught mathematics at the then Kingston Polytechnic to all kinds of learners including adults studying for a mathematics degree part-time, and all manner of mathematics service teaching. After two more children, I decided to move into continuing education to support women and men who, for whatever reason, had missed out the first time round and wished to return to study. I became more and more interested in opening up routes for adults to both mathematics and higher education. This career choice led me to Hillcroft College then later to the Department of Continuing and Adult Education at the University of Exeter.

Earlier in my career, I taught in a humanistic student-centred way but with a belief in the truth, beauty and abstraction of mathematics - a belief that mathematics is a 'peek into the mind of God', is already 'written in the sands'.

Three factors caused me to question this value-free, culture-free notion of mathematics. Firstly, through feminism, I became aware of the deeply unequal nature of both society and the constructs of society. Secondly, through my work in teaching, development and research over many years with adult returners, I became interested in the reasons that mathematics held the particular and peculiar place that it unquestioningly does in so many adults' minds. Lastly, but most importantly, I became committed to the notion that adult education has a vital role to play in a democratic society. I became convinced that the low levels of numeracy in our society limit participation and critical citizenship.

This book is therefore the result of all my working life - my teaching in mathematics itself, my work with adult returners, my research and my abiding interest in critical citizenship and the role mathematics has to play in this. It is my hope that it will be of interest to anyone concerned with mathematics, mathematics education, adult education and a democratic and more just society. It is written for people involved in the teaching and learning of mathematics but will also be of interest to all involved in adult education.

Adults Count Too examines the low level of numeracy in our society, the reasons why this is critical and the forces acting on adults which contribute to this state of affairs. These forces include experiences and philosophies of mathematics and mathematics education, social and cultural factors, political imperatives and the aims and aspirations of the adults who, despite all

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As theory is an essential basis for the acquisition of new ideas with consequent change in practice, the book examines these issues from a theoretical perspective. But it is also grounded in practice and the belief that adults learn best when mathematics teaching builds on positive attitudes, is interactive and co-operative, practical and relevant, set in a social, historical and cultural context and enjoyable and fun. It was written in the hope that it would contribute to a more empowering curriculum for adults learning mathematics, a curriculum which would, first and foremost, fulfil the priorities of the individual but would also take into account the different needs of the diverse population of adults learning mathematics, building on their life, work and social experience.

It recognises but rejects the discourse of mathematics for social control where mathematical literacy is seen as a way of maintaining the *status quo* and producing conformist and economically productive citizens. Similarly, it rejects the approach of deficit and disadvantage where any problem with mathematics is located in the learner rather than the system. It moves away from an individual skills-based approach to one of a critical analysis of social and economic factors, a cultural critique of the elitist assumptions about mathematics and mathematics education and a critique of the educational system with its tendency to create deficit models for adults returning to learn mathematics. It is based on the passionate belief that mathematics is a crucial way of knowing that can make a real difference in people's lives but only if it can be seen in the wider context of society, structural inequality and cultural difference.

Our modern society has been dominated by certain cultures and ways of thinking. In the new post-modern world, this is being questioned at all levels. There is a growing recognition that there are alternative world views, truths, realities and cultures, many of which are not recognised or valued by society. This is true in mathematics and mathematics education and this book is concerned with the discovery and recognition of these 'silent' voices. Such an approach built on social, economic, political and cultural awareness, a value system of social justice and equity and a collaborative, co-operative approach to learning, might transform mathematics education for adults into education for empowerment.

The first section on **Adult Education** presents an overview of the adult education environment within which adults learn mathematics. Chapter 1 explores the role and purposes of adult education in our society and Chapter 2 identifies some characteristics of and influences on those who participate in the process as either learners or tutors.

The second section **The framework within which adults learn mathematics** outlines the wider disciplinary, social, political and cultural context within which adults learn mathematics. Chapter 3 examines underlying beliefs about the nature of the subject itself, outlining, on the one hand, an absolutist philosophy of mathematics and, on the other, an alternative fallibilist approach. Chapter 4 introduces the three main players when adults learn mathematics - the learner, the tutor and the curriculum - and identifies a matrix of forces which act on all three. In chapters 5, 6 and 7 the players are positioned in the framework by an examination of both their aims and goals and the effect on the learning and the approach to teaching of current cultural, political and educational forces and experiences or philosophies of mathematics.

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Section 3 **Understanding adults learning mathematics** deepens the investigation of the factors affecting adults learning mathematics by examining these from different perspectives. Chapter 8 exposes the low level of confidence and knowledge of mathematics in the adult population whilst Chapter 9 looks at whether this is fundamentally injurious to a democratic society. Chapter 10 introduces the concept of discourse and how this can be utilised to facilitate the teaching of mathematics to adults. The next four chapters (chapters 11,12,13 and 14) concentrate on the importance of recognising and valuing diversity and difference through the notion of culture. Chapter 15 builds on this notion by illustrating how individuals acquire an often very effective mathematics-which-works located in their own lives and culture but have difficulty transferring this knowledge across into formal academic mathematics.

Section 4 **Implications for practice** builds on the increased awareness of the framework within which adults learn mathematics to move towards the development of a more emancipatory curriculum.

A matrix of factors

The aim of all education, including mathematics education, is to enable learners to satisfy goals such as vocational and personal development but also facilitate and encourage learners to participate fully as citizens. In a democratic society, this implies curricula that serve everyone in that society, with aims and objectives located in human and social good and which are not just consumer-driven, corporate or reproductive. The thesis of this book is that by this criterion, mathematics education at all levels alienates and fails a large proportion of the population but that it is possible to start to change this situation by locating all mathematics education for adults in a philosophical, political, historical and social framework with a curriculum and pedagogy informed by this conceptualisation.

Learning mathematics

What learners learn is a result of attempting to solve their own problems: people learn mathematical knowledge if the problems that they have are mathematical. Adults will not learn mathematics if they see mathematics problems as someone else's problem, whether the someone else be the tutor or sections of society with which the learner does not identify. But adults, either individually or in groups, do have mathematical problems in their everyday life. This results in not just one mathematics but many.

As well as the mathematics that is commonly taught in educational institutions (academic) mathematics, there are many other forms of mathematics that have been devised by different groups to meet the needs of their own cultures. Each has its own discourse and is valid and legitimate within the cultural group. These can be called local or ethnomathematics ie, the mathematics which are practised by identifiable cultural groups. Culture here is defined widely to include not only gender, class, ethnicity and age but also vocational groupings (D'Ambrosio 1991). The set of all local or ethnomathematics includes the set of formal academic mathematics which is the ethnomathematics devised and owned by the powerful and dominant in our society. This mathematics dominates to such an extent that in Western society it is seen as the only legitimate mathematics. Consequently there is an overwhelming tendency for the formal mathematics curriculum to be concerned only with academic mathematics and not local or ethnomathematics. Hence, the role of mathematics education is often seen as giving the learner fluency in some required aspects of formal mathematics by building on the learner's existing knowledge in academic mathematics only . This process is illustrated in Figure 1.

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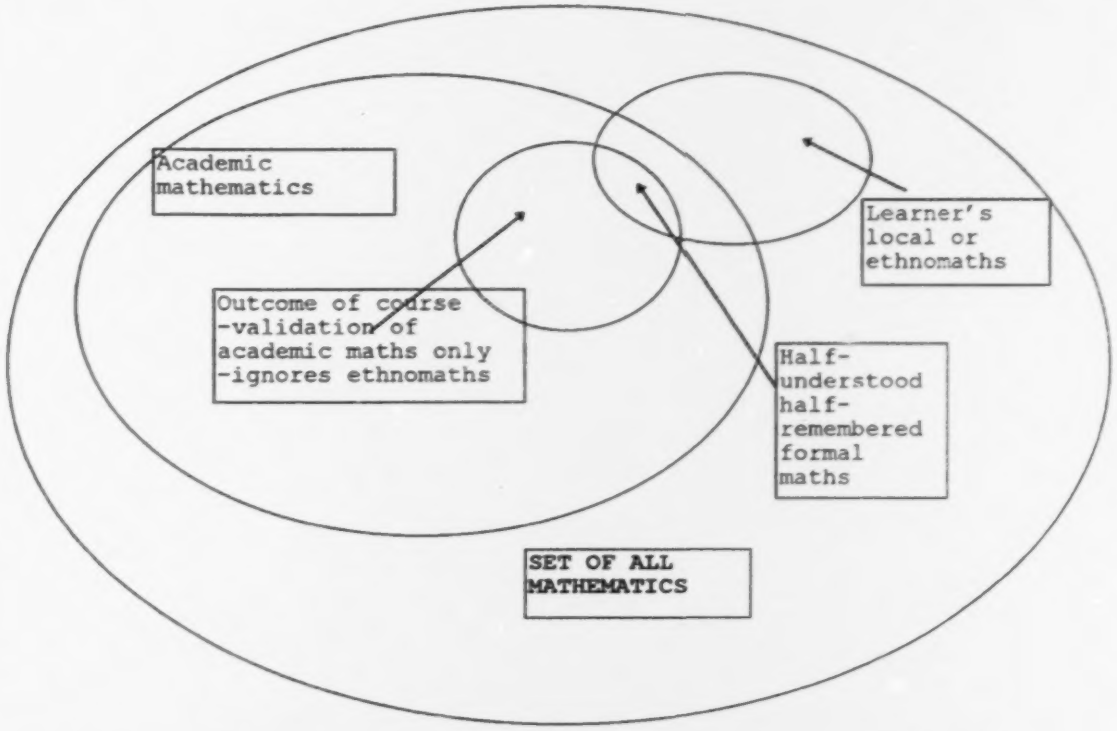
Figure 1: Learning map which ignores learner's own local mathematics.


Academic mathematics
Learner's local or ethnomaths
Outcome of course -validation of academic maths only -ignores ethnomaths
Half-understood half-remembered formal maths
SET OF ALL MATHEMATICS

Superficially, this makes pedagogical sense. After all, a comprehensive grasp of academic mathematics ensures that the codification from real world problems to mathematical abstraction and *vice versa* causes no serious problems. Local or ethnomathematics, being the mathematics used by only a certain section of society, are limited hence codification both ways can cause serious problems. It might reasonably be concluded that it is 'better' pedagogical practice to continue to ignore ethnomathematics. However, this approach has not worked, or rather has only worked for a segment of society. Many people never acquire the requisite comprehensive grasp. For some (white middle class males from professional backgrounds) there does appear to be a good correlation between their ethnomathematics and academic mathematics. Academic mathematics is, in reality, constructed on the needs and problems of this group and is therefore their own local or ethnomathematics.

However, for other more marginal groups such as women, minority ethnic groups and lower socio-economic groups the story is very different. In a worst case scenario, there may be little or no overlap between the syllabus of academic mathematics and the learner's ethnomathematics. The likely outcome is disenchantment and failure or, at best, the mathematics learnt is supported by a very shaky foundation. This approach pathologises the learner and designs techniques that will change the learner's behaviour and inculcate coping skills to make up for what are claimed to be objectively identified deficiencies (Collins 1991). This shows disrespect for the experiences and knowledge of the learner and disrespect for their potential power. The knowledge of the learner remains buried and invisible.

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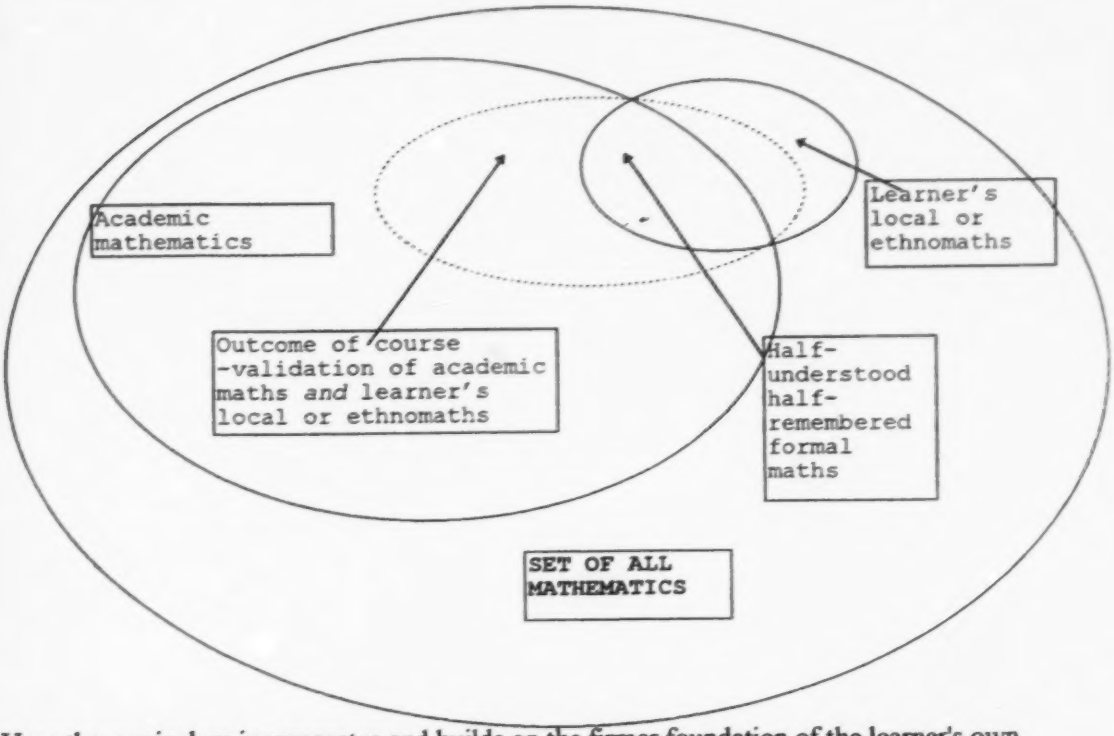
An approach based on Figure 2. may rectify this,

Figure 2: Learning map which builds on learner's own local mathematics.


Academic mathematics
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Outcome of course -validation of academic maths *and* learner's local or ethnomaths
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SET OF ALL MATHEMATICS

Here the curriculum incorporates and builds on the firmer foundation of the learner's own ethnomathematics and, by use of metaphor, builds from what is understood and valued by the learner into what is not understood but is desired by the learner. With ownership of two mathematical discourses, the learner can move freely between the permeable boundaries with the ability to choose in a given circumstance which it is appropriate to use.

This approach respects the learner's knowledge and contributes to the development of both this knowledge and the learner's empowerment. It builds on the mathematics that the learner has previously acquired to solve their own problems. It more effectively allows the learner to achieve mathematical aims through the acquisition of more mathematical tools to solve the learner's mathematical problems. It also allows the learner to achieve social aims through the acquisition of qualifications in academic mathematics to solve the learner's social problems.

The learning continuum

But in a democracy, adults need to learn mathematics not only to develop skills to generate and solve their own mathematical problems, nor just to gain qualifications. They also need to understand why and how mathematics is generated, used and maintained in our society with concomitant consequences for democracy and citizenship. Every curriculum lies on a continuum as shown below, with banking education for control, reproduction and conformity to the *status quo* on one end and emancipatory education for democracy, independence and self-direction on the other.

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The curriculum

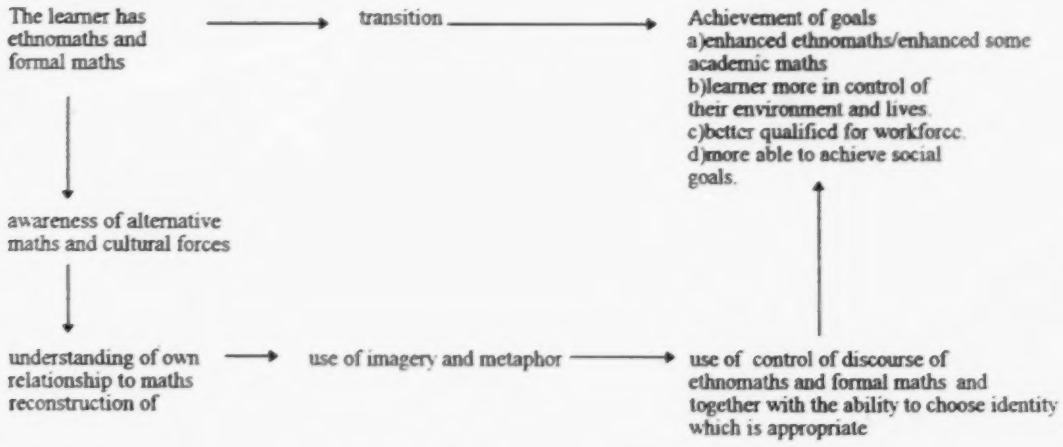
Emancipatory education <----------> Banking education

Ultimately education can lead to reproductive or liberatory change: the former domesticates learners by simply helping them to adjust to socially expected development tasks whilst the latter assists them to question fundamentally their perspectives on the world and their place in it (Tennant 1994). There is always a belief and value system at the centre of any curriculum. At present, the system is implicit and tacit. The dominant forces are located in a market-driven reproductive system whose prime purpose is the continuation of the *status quo* and the economic imperatives of Britain plc. In a democratic society, value systems should always be explicit and mathematics educators need to move towards the construction of alternative value systems for the formal education of mathematics for adults. A more democratic humanist approach would require a critical evaluation of the socio-economic and political realities of society and endeavour to allow individuals more effectively to be in control of their environment and lives through their own understandings and actions. Whether adults seek to learn mathematics for utilitarian work or life reasons or to be more in control of their lives or to achieve their own social goals, they will be better able to achieve their ends with a clearer understanding of mathematics and their relationship to it.

The learning pathway

The prime purpose of the mathematics classroom is to allow the learner to achieve their stated objectives. The educational process is the transition from the learner's present knowledge of mathematics to the achievement of the learner's goals, whatever these might be. However, the process may well be ineffective unless and until the learner can locate themselves and their experiences in the wider framework that encompasses philosophical, historical, cultural, political and educational factors. Figure 3 illustrates the steps necessary to achieve effectively the required transition.

Figure 3: The learning pathway


The learner has ethnomaths and formal maths
transition
Achievement of goals
a)enhanced ethnomaths/enhanced some academic maths
b)learner more in control of their environment and lives.
c)better qualified for workforce.
d)more able to achieve social goals.
awareness of alternative maths and cultural forces
understanding of own relationship to maths reconstruction of
use of imagery and metaphor
use of control of discourse of ethnomaths and formal maths and together with the ability to choose identity which is appropriate

This is not to argue that raised awareness of these forces is sufficient to produce transformations of social reality. The critical reflective approach, which this book argues

should be an outcome of the curriculum, may be rejected by the learner, be accepted in the context of the classroom but not transferred elsewhere in the learner's life, or result in frustration and anger on the student's part over an increased awareness of forces and circumstances which the individual cannot change. An emancipatory intent is no guarantee of an emancipatory outcome. This is not to argue against this more emancipatory form of education: far from it, but educators need to be aware of these potential outcomes. A realistic assessment of the outcomes of any change of teaching is that individuals might be more frustrated in their new state of consciousness but they may also be more empowered to join attempts to change to a more just society. The net result in our consensual society will not be revolution but might lead to a slight shift in the political climate towards a more democratic and participatory society.

A matrix of factors

The powerful forces operating on the three main actors in the learning and teaching process - the learner, the tutor and the curriculum - can be represented by the matrix shown in Table 1.

All elements in the matrix are vectors ie, variable with both direction and magnitude. Each is acting on the learner, tutor or curriculum with a push or pull factor of varying strength towards either an emancipatory, empowering education or a banking, reproductive one. No variable is intrinsically more important than any other: each has an impact. The strength and direction will vary over individuals, institutions and societies and over time. The purpose of the book is to reconceptualises the process of adults learning maths in terms of this matrix. *Adults Count Too* examines this framework from the position of the key actors - the learner, the tutor and the curriculum - then apply this to the development of the curriculum.

Roseanne Benn, *Adults Count Too: Mathematics for Empowerment*, June 1997, Leicester: NIACE, ISBN 1 86201 007 2.

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Table 1: *Factors acting on the learner, tutor and curriculum*

	Learner	Tutor	Curriculum
Goals	personal development; utilitarian; social purpose.	professional satisfaction; learner's goals; reconstruction of part of tutor's mathematical knowledge.	to enable learning; satisfy value system.
Cultural forces	attitudes to gender, class, race, age, etc: current world view; horizons of time and place.	attitudes to gender, class, race, age, etc.; current world view; horizons of time and place.	attitudes to gender, class, race, age, etc; current world view; horizons of time and place.
Political forces	political expectations; climate of lifelong learning; qualification 'mania'.	political imperatives of government, quangos funding bodies and institutions.	political imperatives of government,quangos funding bodies and institutions.
Educational forces	experiences of school and life.	experiences of school, education and life; dominant educational theories; institutional educational beliefs.	dominant educational theories.
Experiences or philosophies of mathematics	experiences of formal mathematics; ethnomathematics.	personal philosophy of mathematics.	philosophies of mathematics.
Learner	reflective learner.	strong motivation of adult learners.	articulation between learner's goals and curriculum.
Tutor	pedagogical approach.	reflective practitioner. philosophy	articulation of tutor's pedagogy and with that of the curriculum.
Curriculum	match of curriculum to learner's goals.	articulation of tutor's pedagogy and philosophy with that of the curriculum.	—